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Practitioner Interview

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Proposed Questions for Interviews with Water Resources Engineers on Use of Water Resources Systems Analysis in the Engineering Workplace

Prepared by:
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BACKGROUND QUESTIONS (to ask through email ahead of time or at the beginning of the interview)

1. What is your current job title?

   Principal Water Resources Engineer

2. For how many years have you worked in your job?

   I have been doing roughly the same work for 27 years for three different employers. On Monday Oct. 5, that will change. I'm moving into a new arena, but the job may still require a systems approach.

3. What formal training have you had in systems analysis?

   Took a basic systems class in my BSCE undergraduate curriculum from Prof. Erhard Joeres at the University of Wisconsin. Erhard was one of Jon Liebman's students at Johns Hopkins before Liebman moved to Illinois. Erhard invited me to stay on to do a Master's and eventually a PhD. My Master's work (optimal treatment policy for the petroleum industry in the Coatzacoalcos River Basin) was clearly a systems problem, while my PhD stretched the definition a little but I think it fits. My PhD project involved using Monte Carlo simulation to test different operating and management policies for the Great Lakes System.

4. If your professional activities have included systems analysis, for how many years have you performed these activities?

   If one is willing to concede that system simulation, systematic sampling (such as Latin Hypercube) and Monte Carlo all under the definition of systems analysis, then I have been

performing systems work throughout my career accounting for about 25% of my work. I have done very little optimization work except by brute force.

QUESTIONS ABOUT USE OF SYSTEMS ANALYSIS ON THE JOB

5. Describe your job. What is/are your roles/activities in your job?

Surface water modeler.

6. What work projects have used systems analysis techniques to identify/evaluate/select a design or decision alternative?

Mostly for flooding studies: (a) floodplain mapping (b) major flood controls and design. Use event steady flow and long term continuous simulation. Techniques used: statistical analysis, some stochastic modeling, and long-term hydrologic simulation.

7. What systems analysis techniques, software, and/or tools were used?

HSPF, FEQ. Developed in Fortran some routines for modeling wastewater collection systems, deep tunnel, treatment plants, pump stations, CSO, later incorporated in SWMM.

8. Have any projects coupled optimization algorithms with external simulation models, simulated system equations within the optimization framework, or used an optimization algorithm available within a simulation model? If yes, what kinds of simplifications were required in the solution approach?

Haven't used many optimization techniques. In one study, he used Linear Programing.

9. What uncertainty analyses have been used to evaluate designs or decision alternatives? If yes, what assumptions were required? What difficulties (if any) were there in communicating results of the uncertainty analysis to decision-makers?

Many uncertainties: one is the accuracy of the models, two is related to the design storm. Most clients ask for 1% risk. Very difficult to convey the uncertainty to stakeholders.

10. Have projects applied multi-objective decision methods to select a final design or decision alternative? If yes, how was a preferred alternative selected from a set of tradeoffs?

There are always trade-offs, even when solving a single objective project. The most important part of the job is to convey the trade-off. Most of the time, stakeholders prefer the least-cost solution and there is, in general, a strong desire to implement engineered structures. Some of the techniques to convey trade-offs and alternative are: scoring or points systems, decision matrixes. One of the reasons more elaborated techniques are not used is because stakeholders don't understand them and "hate" black boxes.

A lot of feedbacks exist between stakeholders and analysts throughout the project duration. Group meetings with all stakeholders are very unproductive. Two reasons for that: (1) they

stakeholders don't give honest answers in front of other stakeholders, only in private (2) stakeholders have opinions on what other stakeholders are doing wrong and prefer to share them individually. In the end, a project to be successfully implemented, you need the approval of all stakeholders.

USE OF SYSTEMS ANALYSIS IN THE PROFESSION

11. What role should systems analysis play in professional practice? How can the profession more effectively use systems analysis in the future?

    a. What encourages or limits the use of systems analysis in the water resources engineering profession?

He wished systems analysis would be used more. Out of 100 studies or projects, only 2 uses system analysis. Why? People use what companies/engineers are selling and agencies demand approaches well stablished in the market. Not many professionals are knowledgeable about systems analysis. Another reason might be the fact that young engineers (EIT) don't make any decisions on choosing methods in their early careers (10 years). The might suppress innovation and use of systems analysis. The good news is that more private firms are requiring post-graduate degrees, especially masters.

12. What systems analysis skills and techniques should universities teach to prepare new practitioners to successfully join the profession?

Statistics and stochastic hydrology. Some graduates lack fundamentals of hydrologic and hydraulics. Some universities seems to emphasize too much in techniques where their faculty do research in (Example: hydrology classes spending too much time with GIS).

REFERRAL

13. Can you recommend a colleague we should also interview? What is their contact info? Would you be willing to put us in contact with them?